CLAIMS

1. A camshaft (10) comprising:

a shaft (26) formed by cold forging with a powdery lubricant (202) applied to a surface thereof; and

a cam (22, 24) mounted on said shaft (26);

said cam (22, 24) being press-fitted over said shaft (26).

2. A camshaft (10) according to claim 1, wherein said powdery lubricant (202) comprises lime or borax.

3. A camshaft (10) according to claim 1, wherein said shaft (26) has a cut surface (130) defined on a side thereof by shearing.

4. A camshaft (10) according to claim 1, wherein said cam (22, 24) has a shaft insertion hole (32) defined therein by punching.

5. A camshaft (10) according to claim 1, further comprising:

a gear (28) mounted on said shaft (26);

said gear (28) being press-fitted over said shaft (26).

6. A camshaft (10) according to claim 5, wherein said gear (28) is made of synthetic resin and has a metal bushing

(28a) disposed centrally therein, said metal bushing (28a) being press-fitted over said shaft (26).

7. A camshaft (10) according to claim 1, wherein said shaft (26) has a step providing different diameters on both sides thereof, said cam (22, 24) being positioned by abutment against said step.

8. (Amended) A method of manufacturing a cam (22, 24) for a camshaft (10) of an engine, comprising the steps of:

performing preliminary profile upsetting on a forging blank having a volume which is greater than a final product by a predetermined amount, thereby forming a first cold-forged body (42) which is thicker than the final product, said first cold-forged body (42) having a rough shape which has an outer profile greater than that of the final product;

performing profile drawing on said first cold-forged body (42) to form a second cold-forged body (54), said second cold-forged body (54) having excessive material that has flowed along a profile of an outer circumferential surface that corresponds to a shape of the final product being formed as a burr (56) on an outer surface thereof;

punching said second cold-forged body (54) to form inner and outer surfaces simultaneously thereon, thereby forming a third cold-forged body (70) with said burr (56) removed from the outer surface, said third cold-forged body (70) further having a relief hole (66) which is smaller in

diameter than a shaft insertion hole (32) for the camshaft (10);

pressing said third cold-forged body (70) to form a fourth cold-forged body (82) having a predetermined thickness and including an excessive material formed as a burr (78) on the inner surface thereof, while an outer circumferential surface of said third cold-forged body (70) is constrained by a die surface;

punching said fourth cold-forged body (82) to remove said burr (78) from said inner surface, thereby forming a fifth cold-forged body (92) having a hole corresponding to said shaft insertion hole (32); and

ironing said fifth cold-forged body (92) simultaneously on inner and outer surfaces thereof, thereby forming a final product.

9. A method according to claim 8, wherein when the preliminary profile upsetting is performed on the forging blank, first and second beveled facets (46a, 46b) are formed on peripheral portions of said first cold-forged body (42).

10. A method according to claim 9, wherein said first beveled facet (46a) is formed on a peripheral portion of a first surface of the first cold-forged body (42), which is positioned near the burr (56) formed by profile drawing on the outer surface, and said second beveled facet (46b) is formed on a peripheral portion of a second surface of the

first cold-forged body (42) opposite to said first surface, said first beveled facet (46a) having an area greater than said second beveled facet (46b).

11. A method of manufacturing a shaft (26) for a camshaft (10) of an engine, comprising the steps of:

coating an outer circumferential surface of a cylindrical blank with a powdery lubricant (202);

axially pressing an end of said blank to draw said blank into a workpiece having a plurality of diameters;

axially pressing said end of the workpiece, and fixing an opposite end of the workpiece to expand a portion thereof radially outwardly into an annular expanded portion; and

axially pressing said annular expanded portion into a flange (26f) while drawing the workpiece into a workpiece having a plurality of diameters;

wherein said steps of axially pressing the end of said blank and axially pressing the end of said workpiece are performed by cold forging.

12. A method according to claim 11, wherein said powdery lubricant (202) comprises lime or borax.

13. A method according to claim 11, further comprising the step of:

forming a cut surface (130) on a side of said workpiece by shearing.

Brief Statement based on PCT Article 19 (1)

The amendments find support in paragraphs [0045], [0051] and [0056] of the description.

An object of the present invention is to reliably obtain a final product with high dimensional accuracy and a predetermined surface roughness. In the present invention, a first cold-forged body having a rough shape, which is thicker than the final product and has an outer profile greater than that of the final product, is subjected to a drawing process and then to an ironing to form a final product. In contradiction thereto, in the cited reference of JP 2003-285138 A, the profile is set to become larger as the processes are conducted, so that an outer profile is formed by upsetting.